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Shaping the Future



**Enabling University-
Industry Collaboration to
deliver High Quality and
High Impact**

Professor David Mullins

**Director External &
International Relations, WMG,
University of Warwick, UK**

About WMG

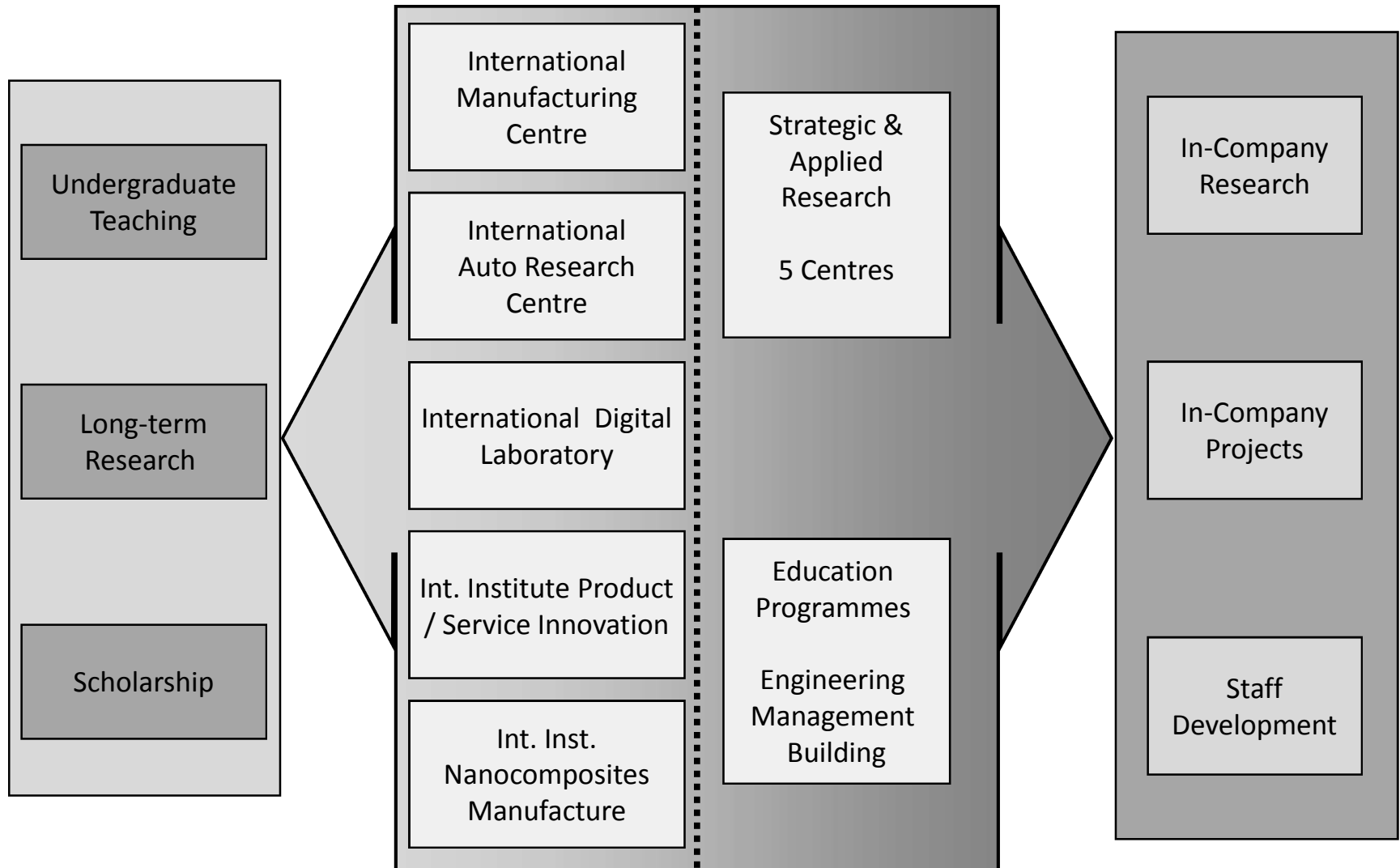
- **University of Warwick Manufacturing**
 - Research, Education, Implementation
- **World class research**
 - 90% world-leading/internationally excellent (HEFCE: REF 2014)
- **High Impact**
 - UK Lambert, Wilson, Witty Reviews of University - Business Collaboration
- **Improving skills base**
 - From school to postgraduate



The Role of Collaboration and Impact

- Engineering, technology and business are applied subjects – collaboration and impact at their heart
- Role to put knowledge in form that can be used
- Create tailored mechanisms '*pathways to impact*' to enable exploitation - can't leave to chance
- Focus on how a 'customer' can most easily absorb
- Partnerships, research, unique facilities, education, demonstrators and knowledge transfer

Intermediate Institute

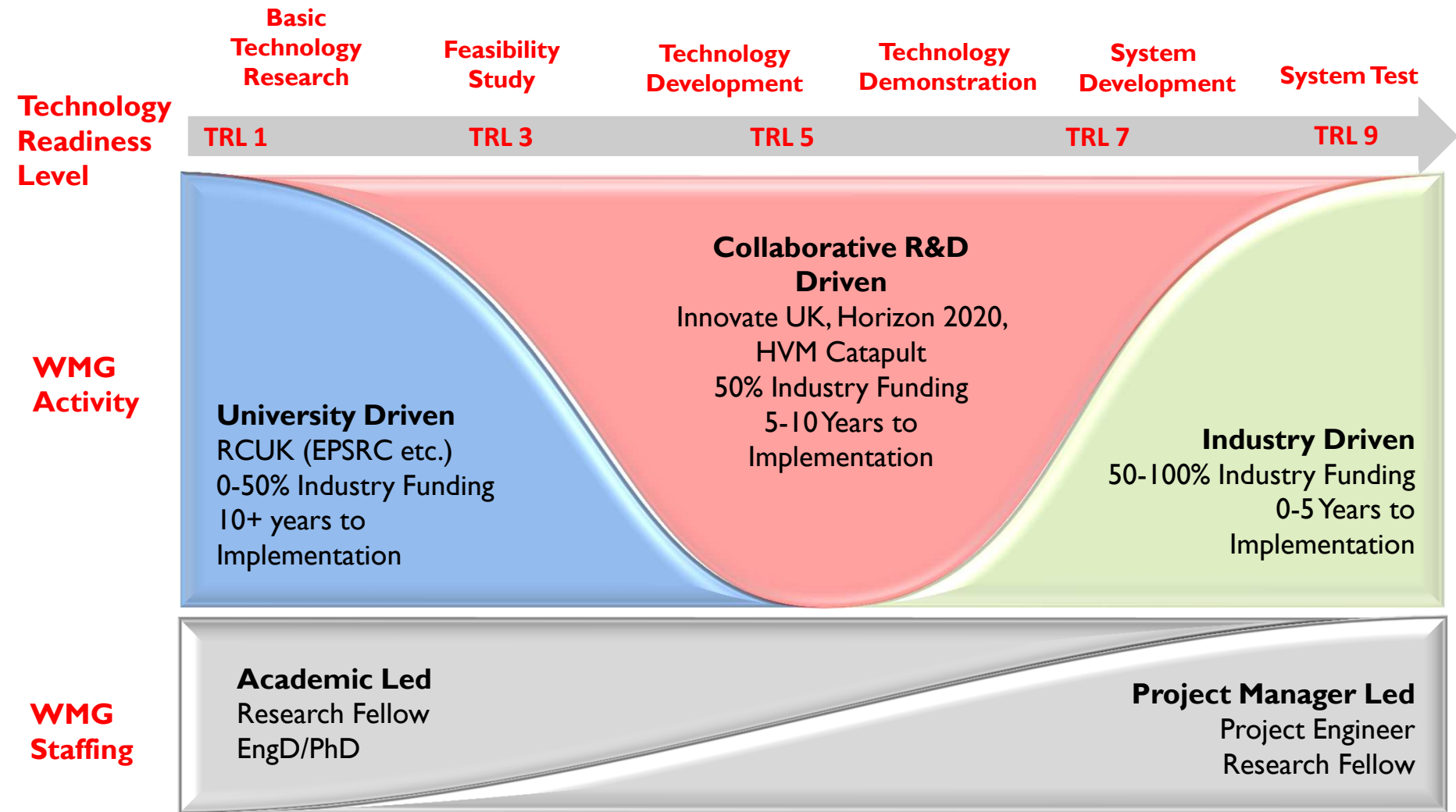


Research Priorities

Research Group	Lead Academic	Theme
Experiential Engineering	Cain	DESIGN
Visualisation	Chalmers	
Engineering Materials & Manufacturing	Dashwood	MATERIALS
Steels Processing	Seetharaman	
Nanocomposites	McNally	
Sustainable Materials & Manufacturing	Kirwan	
Electrochemical Engineering	Dashwood	
Net-Shape Manufacturing	Barnes	MANUFACTURING
Metrology	Williams	
Automation Systems	Harrison	
Digital Lifecycle Management	Ceglarek	
Energy & Electrical Systems	Jennings	
Propulsion Systems	Greenwood	SYSTEMS
Biomedical Informatics, Imaging & Healthcare Technology	Arvanitis	
Cybersecurity	Watson	BUSINESS
Service Systems	Ng	
Supply Chain	Godsell	

User Engagement
 WMG centre High Value Manufacturing Catapult
 Institute for Digital Healthcare
 Education Programmes
 SME Programmes

Research Landscape



Unique Facilities – e.g. Energy Innovation

- UK Energy Storage R&D Centre: to enable battery scale-up and develop processes to take new chemistries from lab to power pack
- Research Council SUPERGEN Energy Storage
- UK's £ 90m Spearheading Future Electric Vehicle Battery Production
- Enabling Electric Vehicle Land Speed Record holding Drayson vehicle



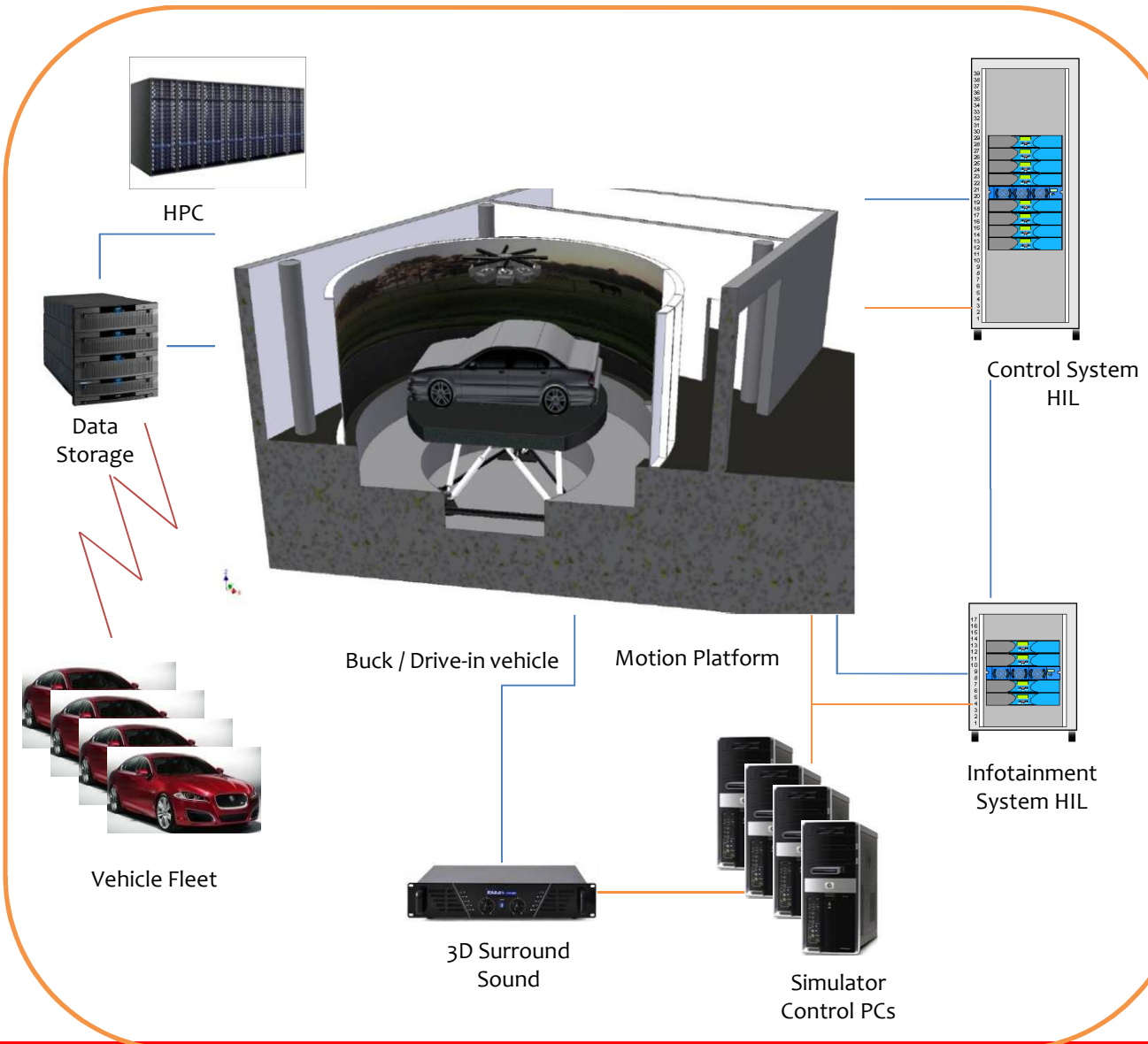
Unique Facilities – e.g. Autonomous Systems Simulator

Research Challenges

Smart & Connected Vehicles
Wireless Networks
Autonomous Operations & Vehicles

Self learning Car
Systems & Software Design
Cybersecurity

Driver Distraction
Virtual Decision Making
In Vehicle Voice & Gesture Recognition



Automotive Research

- Premium Automotive R&D Programme (PARD)
- Four year strategic programme including 170 supplier companies
- 17 research projects with wide dissemination through 2 skills projects
- Numerous implementations in existing and new vehicles
 - 295 New Products and Processes
 - 5,439 Learning Opportunities
 - ¥ 900M Additional R&D investment
 - ¥ 1.3bn Value Added
 - ¥ 300M Private Sector Leverage

Automotive Simulation Project: Partners



High Value Manufacturing Catapult

HVM Catapult provides access to world class assets and talent with co-location of engineers and scientists enabling cross-sector learning.

Uniquely it provides industry the ability to:

- Influence government investment in innovation
- Shape and drive the research agenda (UK & EU)
- De-risk investment in innovation
- Inspire, train and up-skill staff
- With sustained matched public funding



WMG centre HVM Catapult

- WMG is part of the UK government's first Catapult as one of seven partners.
- Launched October 2011
 - £ 220M pa core funding
 - £ 220M pa industry match funding
 - £ 220M pa other UK / European funding
- WMG focus on Low Carbon Mobility
(Automotive with Rail, Marine, Yellow Goods and Aerospace)

Lightweight Product/
System Optimisation

Materials &
Manufacturing

Energy Storage and
Management

Hybrid & Electrical
Systems

Digital Validation and
Verification

Product & Design
Evaluation

WMG Digital

Advanced Propulsion Centre (APC)

- A £ 9bn commitment between UK Government and the automotive industry
- To Position the UK as a global centre of excellence in Advanced Propulsion
- WMG selected to host the Hub of the APC
- Initial collaborative research projects funded
- Skills programme scoped



Institute of Digital Healthcare

The Institute of Digital Healthcare (IDH) is a co-funded collaboration programme between NHS West Midlands, WMG and Warwick Medical School.

Improve people's health and wellbeing through the use of innovative digital technologies and methodologies.

Healthcare
Technology

Education Innovations

- WMG Academy for Young Engineers - business-focused, business-led innovative school
- Innovative industry skills programmes– 30,000 awards
- Major programmes include
 - *AstraZeneca, BAE Systems, Network Rail, Rolls-Royce, UTC Aerospace*
- Technical Accreditation Scheme - 3,000 technology Masters modules taken by staff to date – 8 Universities
- Applied Engineering Programme - Online undergraduate programme for company staff
- Training banks on investment decisions in manufacturing e.g. Barclays, Lloyds, RBS and Santander
- Research Council Doctoral Training Centre / Engineering Doctorate

Hands On Education

Professional & Executive Programmes

- Intended to develop high-potential employees and to extend the capabilities of business managers / leaders
- Designed to be adaptable to meet the needs of the business and employee
 - Scale: single 2 ½ day module to a full MSc
 - Modules: typically 4 ½ or 2 ½ days in duration
 - Content: wide range of subject areas
 - Schedule: high degree of flexibility

Modules (2 ½ and 5 day)

Business Modules

- Business Awareness
- Commercial & Industrial Law
- International Joint Ventures
- Managerial Accounting & Control Systems
- Strategic Marketing
- Business Policy & Strategic Management
- E-Commerce
- Financial Analysis & Control Systems
- Financial Decision Making
- Global Business Environment
- Global e-Business
- Legal Aspects of Global Business
- Management of Change
- People in Organisations

Operations Modules

- Design Management
- Improving Business Performance
- Improving Manager Performance
- Industrial Engineering
- Logistics Planning
- Process Analysis
- Process Improvement

- Project Planning, Management and Control
- Quality Management
- Manufacturing Planning & Control
- Manufacturing Process Capability
- Supply Chain Management
- Total Productive Maintenance
- Working in Teams
- Applied Statistical Methods
- Business and Operations Design
- Collaborative Product Development
- Creating Business Excellence
- Design for the Environment
- Improving Personal Performance
- Innovation Strategy
- Knowledge-based Asset Management
- Leadership
- Leadership & Excellence
- Lean Principles & Application
- Logistics & Operations Management
- Managing the Multi-Project/Programme Environment
- Operations Strategy for Industry
- Process Improvement Using Six Sigma

- Product Design & Development Management
- Product Excellence Using Six Sigma
- Quality Management and Techniques
- Robust Design & Development
- Simulation of Production Operations
- Storage & Warehousing Techniques
- Technology Management

Technology Modules

- Dimensional Management
- Information Technology
- Process Modelling
- Advanced Materials & Processes
- Automation and Robotics
- Enterprise Information Systems
- Information & Communication Technologies
- Machining Technologies
- Manufacturing Process Technologies
- Manufacturing Technology
- Materials Engineering
- Packaging

Education Pathway

Demonstrator Programmes

Working with SMEs

- **20% - Late adopters**

Awareness briefing, case studies, demonstrators

- **45% - Mainstream SMEs**

Intensive company projects – prototyping, identifying markets, internships, product/service evaluation

- **25% - Leading edge SMEs**

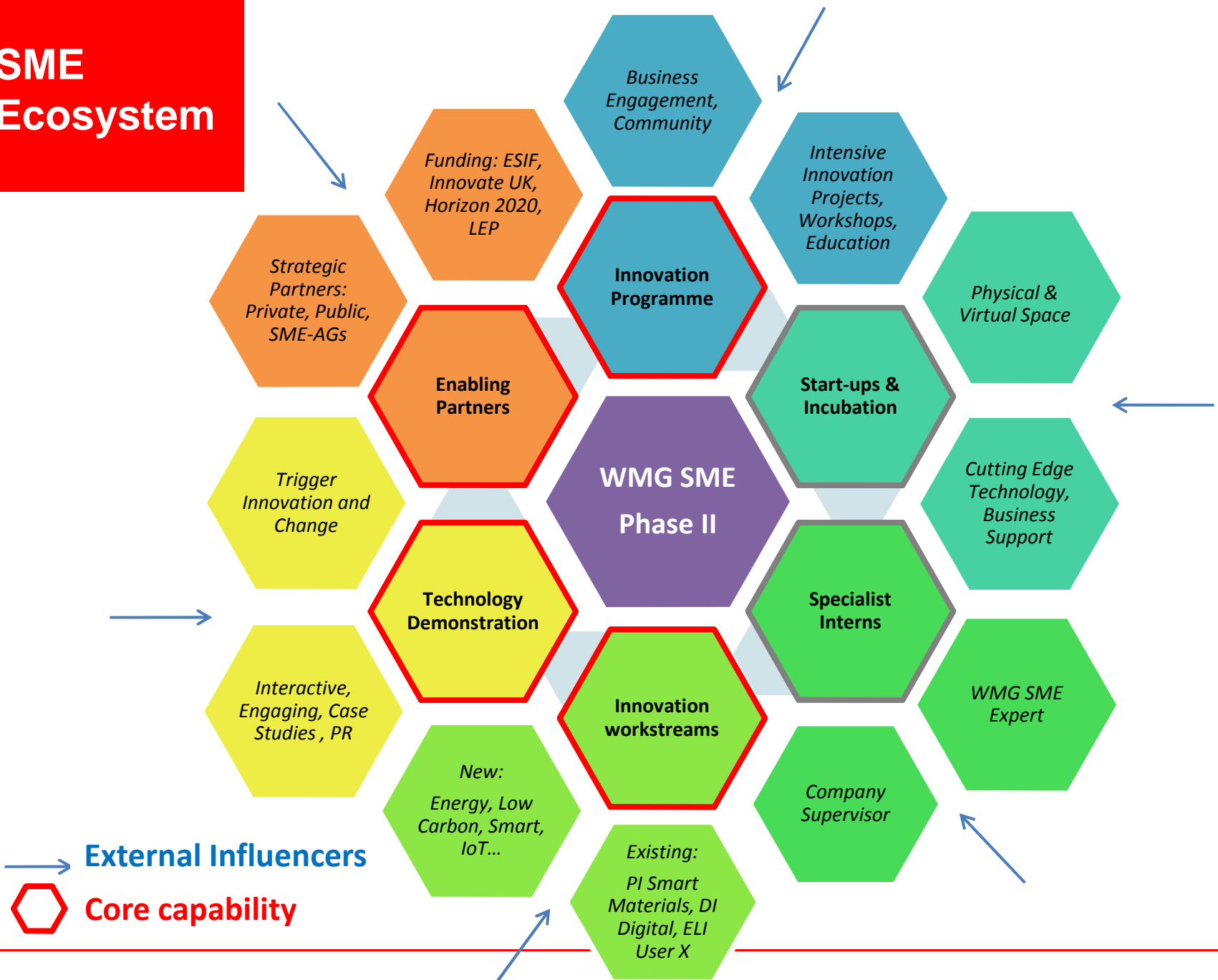
In-depth workshops, advanced demonstrations, horizon scanning, hands-on

- **10% - Feasibility to full R&D**

Feasibility studies, collaborative projects assistance with funding / grant applications

Small & Medium Sized Enterprises

SME Ecosystem



→ External Influencers
Core capability

Collaboration and Impact: Automotive

- **Strategic Programmes:**
 - Tata Motors, Jaguar Land Rover and 300 suppliers
- **Pioneering aluminium:**
 - Jaguar XE/XF/XJ/F-Type & new 420kg lighter Range Rover
- Deliver over ¥ 4.5bn value-add
- Facilitate Jaguar Land Rover research and education
- JLR co-located 200 staff and Tata Motors, 300 staff at WMG

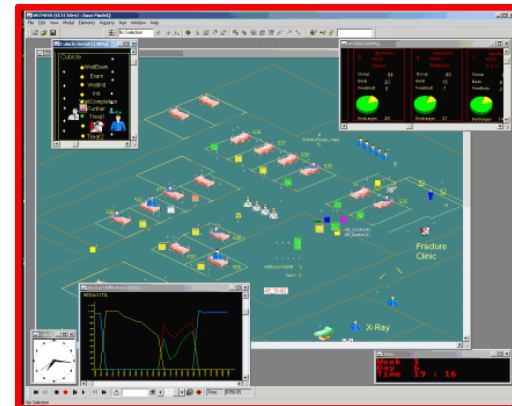


Enabling Growth

Design for manufacture and flexible tooling into Airbus A380

Construction as a manufacturing process with Persimmon – 50% improved energy consumption

Digital Innovation in Institute of Digital Healthcare and Academic Health Sciences Network



National Automotive Innovation Centre

- ¥ 1.3bn investment – one of the biggest private sector investments in any university
- A 33,000m² collaborative research environment
- Unique infrastructure and national focus for R&D addressing UK Automotive Council agenda
- Creating 1,000 and attracting 3,000 further R&D jobs
- Bringing global R&D of major Tier 1 suppliers to co-locate

Many options for partners

- Collaborative R&D in research consortia
- Company specific R&D for future products
- Strategic partnerships with third parties
- Exploration of new application sectors for products
- Specially tailored postgraduate education programmes
- Targeted staff recruitment / internships
- Engineering Doctorate – existing and new staff
- High profile physical presence
- Access to high quality demonstration / presentation facilities
- Co-ordinated relationship and shared publicity

Benefits to Collaboration include

- Funding for research infrastructure
- Funding for research programmes
- Generation of new ideas
- Sharing opportunities across education and research
- Case studies for education programmes
- Career destinations for students
- Collaboration and impact grows individual network and profile
- Collaboration and impact grow University profile and relevance

Thank You